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A.L.

The Response of Selected Owl Species to Silvisultural Treatments of the Dixie National Forest-Utah

Final Report

THE RESPONSE OF SELECTED OWL SPECIES TO SILVICULTURAL TREATMENTS ON THE DIXIE NATIONAL FOREST, UTAH

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Ann L. Woyda

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ABSTRACT

The Response of Selected Owl Species to Silvicultural Treatments on the Dixie National Forest, Utah

by

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University of Idaho, 1982

Major Professor: Dr. Winifred B. Kessler
Department: Wildlife Resources

Owls were searched in representative ponderosa pine (Pinus ponderosa) and Douglas-fir (Pseudotsuga menziesii) forest types within and in the vicinity of proposed timber sale units of the Dixie National Forest, Utah. These searches were made to identify owl species, to determine their distribution, to identify study plots and to establish owl census transects where owl populations may be censused during subsequent breeding seasons. Procedures were delineated for censusing owls. Owl species found included the pygmy (Glaucidium gnoma), saw-whet (Aegolius acadidicus), screech (Otus asio), long-eared (Asio otus), great-horned (Bubo viginianus) and Mexican spotted owl (Strix occidentalis lucida). Twenty-one owls were seen or heard in ten representative forest types within nine proposed timber sale units. Fifty-five, 0.5 mile census transects were established on the study plots. Owls were found in both disturbed and undisturbed areas. Owls indicated a preference for old-growth mixed conifer, riparian zones and thinned stands. Spotted owls may prefer rock ledges and cliffs for nesting and ponderosa pine for roosting. By following censusing procedures,

owl population densities can be determined. By measuring habitat characteristics, preferred habitat can be calculated. Planned silvicultural treatments should provide suitable habitat diversity to maintain owl populations.

(46 pages)

INTRODUCTION

There is a need for studies dealing with the effects of habitat alterations on bird populations in the formation of forest management plans (Conner and Dickson 1980). The opportunity to monitor owl populations in their response to silvicultural activities is a unique one. The Dixie National Forest, located in southern Utah, has developed a five-year cutting plan for 1981-1986 which includes a significant removal of ponderosa pine (Pinus ponderosa) and Douglas-fir (Pseudotsuga menziesii) (Johnson 1981). Little is known about the relationships between owl populations and silvicultural treatments. With increased needs for timber harvesting and other silvicultural practices on the Dixie National Forest, it is important that some information regarding owl populations exists and some means of monitoring those populations is available.

Previous studies on owl populations in southern Utah include those of Behle (1941), Hoffman (1978) and Wauer and Carter (1965). Most of these studies have been conducted on National Parks or lands owned by the Bureau of Land Management.

Several species of owls may be found on the Dixie National Forest, as indicated by geographic distribution. A list of forest owls on the Forest includes the pygmy owl (Glaucidium gnoma), saw-whet owl (Aegolius acadicus), screech owl (Otus asio), long-eared owl (Asio otus), flammulated owl (Otus flammeolus), great-horned owl (Bubo virginianus) and Mexican spotted owl (Strix occidentalis lucida).

Searches for owls within proposed timber sales of the Dixie National Forest should provide useful information regarding owl species occurrence and distribution. Furthermore, the preferred habitat of owls may be characterized from relationships between habitat characteristics and owl occurrence. Data gathered on owls and owl habitat may be useful in the formation of forest management plans on the Dixie National Forest.

The first season of field work was conducted during June-August 1981 on the Escalante Ranger District of the Dixie National Forest as part of a proposed two year study (1981-1982). However, at the end of 1981, the project was terminated. No further data were collected in 1982. This final report includes information gathered during 1981 which satisfies the objectives set for that year. In addition, this report suggests characteristics of preferred owl habitat on the Escalante Ranger District and relates silvicultural treatments to owl populations.

Overall Objective

To determine species and distribution of owls within proposed timber sale units of the Dixie National Forest and devise procedures for monitoring their population responses to planned silvicultural treatments.

Objectives for 1981

1. To identify the study area.
2. To identify suitable study plots.
3. To identify owl species occurring within the study area.
4. To establish owl census transects and procedures.

STUDY AREA

The Escalante Ranger District is in the eastern section of the Dixie National Forest, located in southern Utah (Figure 1). The Escalante Ranger District includes elevations ranging from 5270 feet at Escalante to 10500 feet on the Aquarius Plateau and 11000 feet on Boulder Mountain.

The Escalante Ranger District was chosen as the study area for several reasons. A variety of ponderosa pine (Pinus ponderosa) and Douglas-fir (Pseudotsuga menziesii) forest types occur on the Escalante Ranger District. These types are representative of the research program at the Intermountain Forest and Range Experiment Station: Ecology and silviculture of Rocky Mountain Douglas-fir and ponderosa pine ecosystems. There is also a significant amount of mature to overmature ponderosa pine and Douglas-fir on the Escalante Ranger District. In addition, due to a mountain pine beetle (Dendroctonus ponderosae) problem resulting in high levels of tree mortality, intensive timber harvesting is planned for the Escalante Ranger District.

Furthermore, the Escalante Ranger District was chosen as the study area because a Mexican spotted owl (Strix occidentalis lucida) was located in June 1980 by Mr. Craig B. Pearson, Wildlife Biologist, along Hellsbackbone road (T. 33S, R. 2E, S. 2). The Mexican spotted owl, a rare and sensitive wildlife species for Utah, was not known to live on the Dixie National Forest before this sighting.

Climate

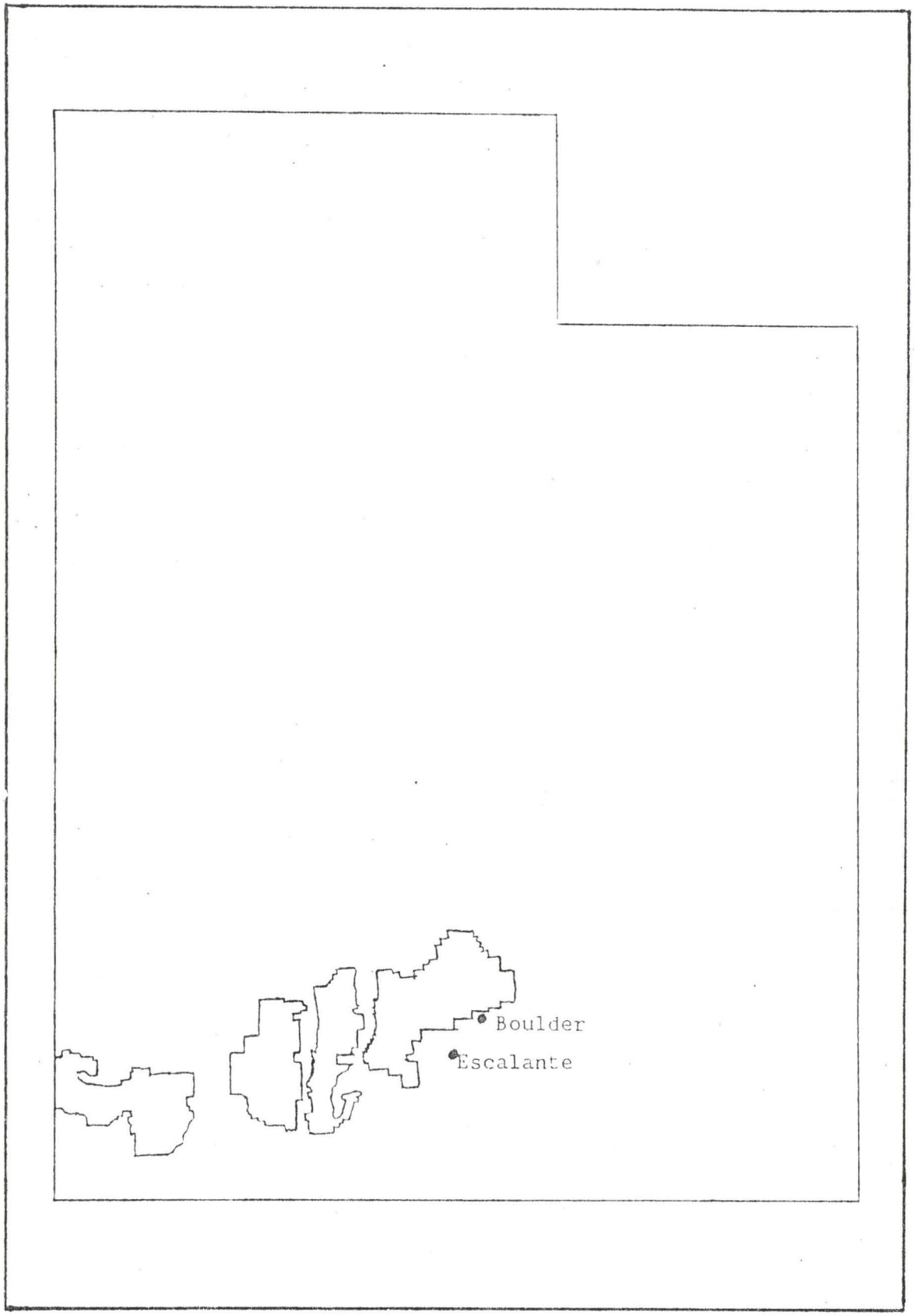


Figure 1. Dixie National Forest, Utah, showing communities of Escalante and Boulder.

The climate of the Escalante, Utah area is characterized by warm summers and cold winters (Table 1). Precipitation is moderate, averaging 12 inches per year. Most of this precipitation is in the form of late summer thunderstorms and winter snow. At the higher elevations of the Aquarius Plateau above Escalante, temperatures are lower and precipitation is greater. Snow can make the Aquarius Plateau and Boulder Mountain inaccessible as late as May during high snowfall years (Dumas pers. comm.).

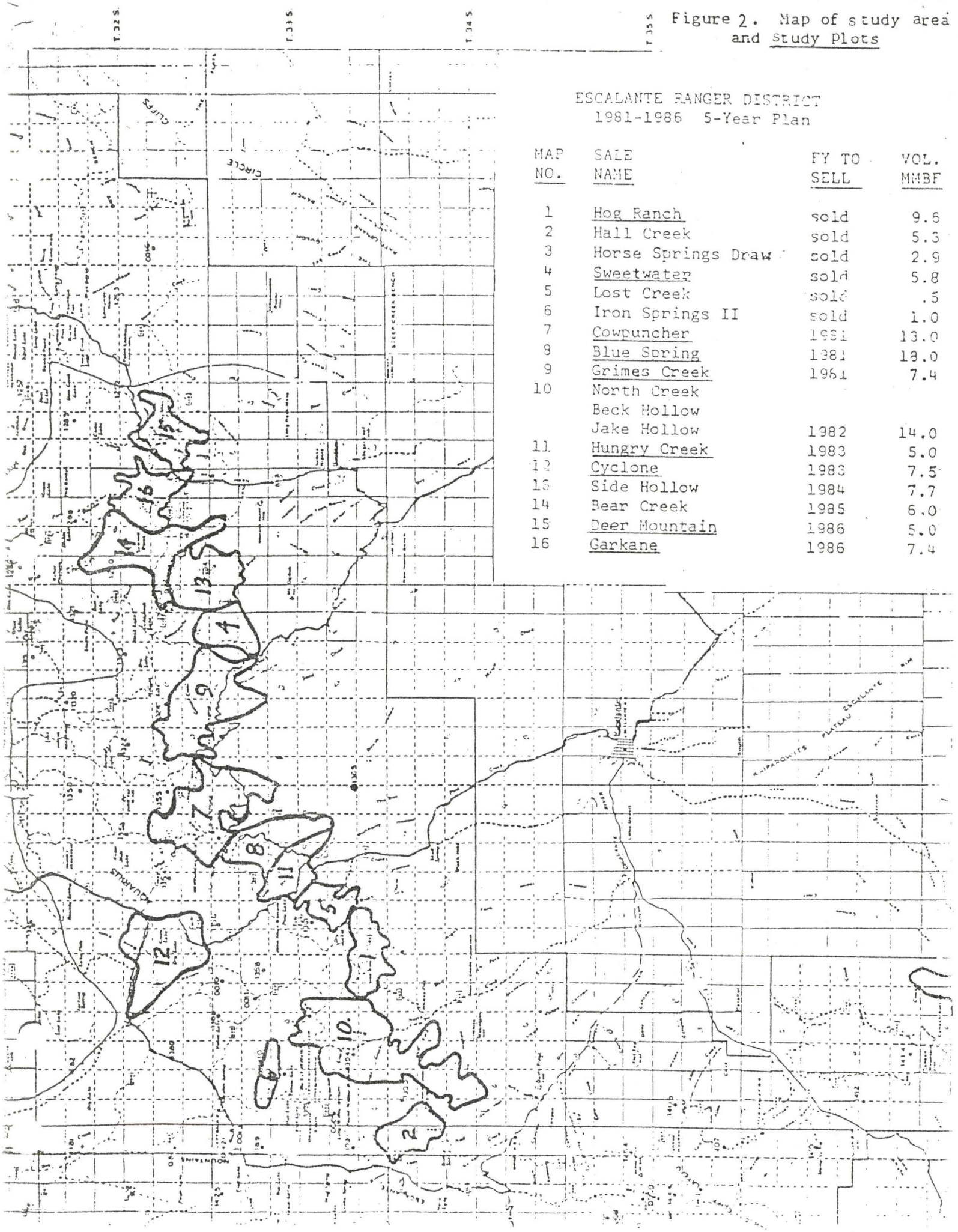
Study Plots

Nine study plots were chosen on the study area (Figure 2). Each plot is a timber sale characterized by ponderosa pine or Douglas-fir forest types, or types containing these species, in which owls were seen or heard June-August 1981. Although owl searches in 1981 were unproductive in the Blue Spring timber sale, it was chosen as a study plot because this forest type is of interest.

Table 1. Mean temperatures and precipitation by month for Escalante, Utah (United States Weather Bureau).

Month	Mean temperature (°F)	Mean precipitation (inches)
January	26.0	1.20
February	31.1	.86
March	38.9	.91
April	47.3	.58
May	55.2	.67
June	63.1	.58
July	70.3	1.35
August	67.9	1.95
September	61.4	1.11
October	50.5	1.11
November	37.4	.64
December	29.0	1.23
Annual	42.2	12.19

Figure 2. Map of study area and Study Plots



ESCALANTE RANGER DISTRICT
1981-1986 5-Year Plan

MAP NO.	SALE NAME	FY TO SELL	VOL. MMBF
1	Hog Ranch	sold	9.6
2	Hall Creek	sold	5.3
3	Horse Springs Draw	sold	2.9
4	Sweetwater	sold	5.8
5	Lost Creek	sold	.5
6	Iron Springs II	sold	1.0
7	Cowpuncher	1981	13.0
8	Blue Spring	1981	18.0
9	Grimes Creek	1981	7.4
10	North Creek Beck Hollow Jake Hollow	1982	14.0
11	Hungry Creek	1983	5.0
12	Cyclone	1983	7.5
13	Side Hollow	1984	7.7
14	Bear Creek	1985	6.0
15	Deer Mountain	1986	5.0
16	Garkane	1986	7.4

METHODS

Owl Census Transects

Owl census transects were established along Forest Service roads within study plots. First, complete surveys were made of entire sale areas, regardless of habitat composition. Roads in and around all timber sale areas in the study area were searched intensively for owls. Searches were conducted by soliciting owls at night and during the day with taped recordings of owl calls, using a cassette player and ½ Mile Hailer amplifier, stopping at 0.5 mile intervals. Then, potential sites--those characterized by ponderosa pine and Douglas-fir forest types--were censused. Finally, census transects were established to include potential sites from which owls responded in 1981. These transects run along roads within and in the vicinity of study plots. Fifty-five transects were established, each 0.5 mile long, totalling 28 miles of transect for censusing. The choice of transect length was influenced by the uniformity of vegetation and topography within 0.5 mile segments. A series of transects were established in each forest type to obtain sufficient sampling and provide replications of the forest type. The number of replications varied with the abundance of each forest type in the study area. Table 2 lists the number of transects and the location of these transects in each forest type. Transects run through well-defined major forest types. These types include ponderosa pine, Douglas-fir, spruce and aspen types of various stand size classes, in addition to noncommercial ponderosa pine and nonforest types. A list of the forest types found on each study

Table 2. Forest types, number and locations of 0.5 mile census transects on study plots on the Escalante Ranger District, Utah (1981).

Forest type symbol	Study plot	Transect #	Transect location
P9AMP	Hungry Creek	1-2	0-1 mile east of Cowpuncher turnoff Hellsbackbone road
	Hungry Creek	3	0-½ mile west of Posy Lake turnoff Hellsbackbone road
	Hungry Creek	4	1-1½ mile west of Posy Lake turnoff Hellsbackbone road
P9BMP	Hungry Creek	5	1-1½ miles east of Cowpuncher turnoff Hellsbackcone road
	Blue Spring	6-11	1½-4½ miles east of Cowpuncher turnoff Hellsbackbone road
P9APP	Cowpuncher	12-16	4½-7 miles east of Cowpuncher turnoff Hellsbackbone road
	Grimes Creek	17	0-½ mile east of Hellsbackbone bridge
	Garkane	18-21	1-3 miles northwest of Garkane hydroelectric plant turnoff Boulder-Torrey road on Baker Pasture road
	Deer Mountain	22-26	0-2½ miles northeast of Garkane hydroelectric plant turnoff on Boulder-Torrey road
P9BPP	Sweetwater	27-29	0-1½ miles north of Hells-backbone road on Sweetwater sale road
	Cowpuncher	30	1½-2 miles west of Hellsbackbone bridge (north side)
	Cowpuncher	31	2-2½ miles west of Hellsbackbone bridge (south side)
D9AMP	Cowpuncher	32	2-2½ miles east of Hellsbackbone bridge (north side)
	Cowpuncher	33	2½-3 miles west of Hellsbackbone bridge
S9AMP	Hungry Creek	34-35	3½-4½ miles west of Posy Lake turnoff Hellsbackbone road

Table 2. Continued.

Forest type symbol	Study plot	Transect #	Transect location
S9AMP	Cyclone	36	5-5½ miles west of Posy Lake turnoff Hellsbackbone road
	Cyclone	37	6½-7 miles west of Posy Lake turnoff Hellsbackbone road
	Cyclone	38	7½-8 miles west of Posy Lake turnoff Hellsbackbone road
A8M	Sweetwater	39-41	1½-3 miles north of Hells-backbone road on Sweetwater sale road
	Deer Mountain	42	2½-3 miles north of Garkane hydroelectric plant turnoff on Boulder-Torrey road
	Hungry Creek	43	½-1 mile west of Posy Lake turnoff Hellsbackbone road
	Cyclone	44	5½-6 miles west of Posy Lake turnoff Hellsbackbone road
A8W	Hungry Creek	45-48	1½-3½ miles north of Posy Lake turnoff Hellsbackbone road
NP	Grimes Creek	49	½-1 mile west of Hellsbackbone bridge
	Grimes Creek	50-51	½-1½ miles east of Hellsbackbone bridge
O	Grimes Creek	52	0-½ mile west of Hellsbackbone bridge
	Grimes Creek	53	1-1½ miles west of Hellsbackbone bridge
	Grimes Creek	54	0-½ mile east of Hellsbackbone bridge
	Cowpuncher	55	1½-2 miles west of Hellsbackbone bridge (south side)

plot is included in Table 3. Table 4 lists descriptions of forest types and the number of transects (replicates) in each type on study plots.

Owl Census Procedures

Census procedures were developed during 1981 to provide a means of making valid owl population and distribution estimates on the study area. These procedures can be used as a guideline for future owl studies on the Escalante Ranger District and the Dixie National Forest.

Eight to ten census trips are recommended over each transect. On each census trip, three minute loop tapes of recorded owl calls are played at intervals of 0.5 mile or less. Calls are to be played for one minute with a 30 second pause, then one or more replays. Calls of the smallest owls should be played first and those of the largest owls last to eliminate the tendency of smaller species to be inhibited by the presence of larger predators or competitors. Owl calls used should include those of the pygmy, saw-whet, screech, long-eared, short-eared, flammulated, spotted and great-horned owls as well as calls of other owls known to occur in Utah. A headlamp and a 200,000 candlepower lamp are useful in identifying species which do not vocalize. Appendix 1 lists the data which should be recorded during each census trip.

In winter, travel may be restricted to skiing and walking. Calling with a cassette player at 0.25 mile intervals may be then necessary. When the study area is accessible by vehicle and a ½ Mile Hailer amplifier is available, 0.5 mile intervals can be used between calling sites. Location information and owl responses should be recorded at each calling site (Appendix 2). Each calling site receiving a positive owl response should be staked and flagged for identification.

Table 3. Owl species found on timber sales on the Escalante Ranger District, Utah (1981).

Map #	Study plot (timber sale)	Forest type	Owl species seen or heard	Comments
1	Hog Ranch	P9APP	Saw-whet	Thinned in 1979-1980; clearcut in areas
4	Sweetwater	P9BPP	Great-horned, saw-whet	Road construction; thinned
7	Cowpuncher	P9APP	Unidentified owls, saw-whet	Unidentified (spotted?) owl observed by survey crews; road construction
8	Blue Spring	P9BMP	--	Thinned; area unproductive in 1981 owl searches but chosen for timber type
9	Grimes Creek	P9APP	Saw-whet	
		NP, O	Spotted	Heard only
11	Hungry Creek	P9AMP	Unidentified medium-sized owl, pigmy	
		A8W	Great-horned	
12	Cyclone	S9AMP	Long-eared, pigmy	
		A8M	Pygmy	
15	Deer Mountain	A8M	Pygmy	
16	Garkane	P9APP	Great-horned	Thinned
		P9APP	Screech, pygmy, saw-whet	

Table 4. Descriptions of forest types found on study plots and the number of replications established in each forest type on the Escalante Ranger District, Utah (1981). (Cover type legend from: USDA 1956 Timber Surveys, Dixie National Forest)

# of transects (Replicates)	Forest type symbol	Forest type	Stand size class (DBH)	Stocking classification[1] (Crown Closure)
4	P9AMP	Ponderosa pine	Small sawtimber (11.00"-20.99")	Poor by sawtimber trees
7	P9BMP	Ponderosa pine	Large sawtimber (21.00" +)	Medium by all trees Poor by sawtimber trees
15	P9APP	Ponderosa pine	Small sawtimber (11.00"-20.99")	Poor by sawtimber trees
5	P9BPP	Ponderosa pine	Large sawtimber (21.00" +)	Poor by all trees
2	D9AMP	Douglas-fir	Small sawtimber (11.00"-20.99")	Medium by all trees Poor by sawtimber trees
5	S9AMP	Spruce	Small sawtimber (11.00"-20.99")	Medium by all trees Poor by sawtimber trees (Type includes Douglas-fir)
6	A8M	Aspen	Pole (5.00"-10.99")	Medium by all trees (Type includes ponderosa pine and Douglas-fir)
5	A8W	Aspen	Pole (5.00"-10.99")	Well by all trees (Type includes ponderosa pine and Douglas-fir)

[1] Stocking classifications: Poor (10-39%), Medium (40-60%), Well (70-100%).

Table 4. Continued.

# of transects (Replicates)	Forest type symbol	Forest type	Stand size class (DBH)	Stocking classification[1] (Crown closure)
3	NP	Ponderosa pine	Noncommercial	--
4	0	Waste, barren	--	(Type is adjacent to ponderosa pine stands)

[1]Stocking classifications: Poor (10-39%), Medium (40-60%), Well (70-100%).

Owls are known to begin breeding in late winter or early spring in Utah. Censusing efforts should be intensified during this breeding period, as it applies to each owl species. Censusing should be conducted primarily during the evening, night and early morning hours. However, attempts should be made during the day to call owls and daylight searches should be made for nests. For each nest found, location and owl information should be recorded (Appendix 3). Each location occupied by owls should be monitored throughout the spring and summer in an attempt to collect nest site and productivity data. Since most owls are known to be non-migratory, censusing over the entire spring-summer period should not be affected by seasonal variations in abundance.

Owl Densities

Densities of owls found within the study area can be estimated from location and distribution data. Density estimates (number of territories per mile of census transect) can be calculated for each species from relative frequency indices, as suggested by Paz et al. (1979) and Marcot (1978). From the number of owl responses per census transect recorded, overall relative frequency indices of territories per census transect and per mile of transect can be calculated. The frequency of owl territories in each forest type can also be calculated.

Habitat Characteristics

Habitat characteristics should be measured during the summer when foliage is present. Habitat can be measured on 0.1 acre plots within each representative forest type. Attempts should be made to make these measurements in a variety of silvicultural treatments. Owl nesting and foraging

sites should be used as plot centers, if possible, to sample areas within the forest types where owls are known to occur. Plot centers should be placed at random within the forest type in areas not used by owls. From this information, habitat which is used by owls can be characterized versus that which is available but is undesirable. Vegetation should be sampled to record stand composition and variability. Attempts should be made to measure at least 10 plots per forest type to effectively use multivariate techniques in the data analysis. A study plot habitat record (Appendix 3) lists the information which should be collected on each 0.1 acre plot and at each nest site.

The sampling technique suggested in this procedure is a modification of the range-finder method (James 1971). Each tree greater than three inches in diameter at breast height (BDH) is identified within the plots to species and its height is recorded. To estimate understory density, two armlength transects totalling 0.02 acres across the circle are made and the number of stems less than three inches DBH intersected is recorded. Canopy closure with a 1.25 inch diameter sighting tube is estimated taking 20 plus-or-minus readings for the presence or absence of foliage sighted upwards on alternate steps of an armlength transect. Canopy height is measured with a clinometer. Herbaceous vegetation is measured and ground cover is estimated from 0.1 Daubenmire plots with frequency and cover measures recorded for each plant species. Measurements of vegetation variables are coded to facilitate handling the data. Aspect and slope are determined with a compass. In addition, stand age is estimated by sampling overstory species and using an increment borer. The elevation of the plot is measured using an altimeter or determined from a topographic map.

Habitat Preference

In order to characterize preferred owl habitat, an analysis of owl habitat must be done. This involves analyzing habitat variables individually and in combination. The extent to which the data may be analyzed is determined by the number of owl observations made. Therefore, it is important that as many owls are located as possible. To determine if certain forest types are preferred over others by an owl species, chi-square values can be calulated for each forest type by comparing actual use of the type to the expected use based on the availability of each type:

$$x^2 = \sum \frac{(O-E)^2}{E}$$

where: O = actual use of forest type by owls
E = expected use of forest type by owls

The availability of a forest type is defined as the proportion of the study area occupied by that forest type. This proportion can be calculated from forest type maps.

In order to use the chi-square distribution, at least one expected observation must occur in each forest type and the average expected observations (over all forest types) must be at least six for the 0.01 level of significance of the test (Neu et al. 1974). The following null hypothesis may be tested by the chi-square technique: an owl utilizes each forest type in exact proportion to its occurrence within the study area. If the expected number of owl occurrences in each forest type differs significantly from the occurrence of forest types within the study area, then the null hypothesis can be rejected. In order to examine which forest types are creating statistical significance in the chi-square statistic, confidence intervals can be constructed using the Bonferroni normal statistic ($z_{(1-\alpha/2)}$) around the observed

utilization values. If the expected utilization value for a given forest type exceeds the limits of the confidence interval, then it can be concluded that the forest type was not selected randomly. Or, that the owl species under study preferred that forest type.

Principal components analysis can be used to combine several continuous variables into smaller sets of variables. Discriminate analysis can be used to determine how much owl species overlap in their habitat preferences. Discriminate functions can be correlated with vegetation variables. Discrete variables (aspect, slope, elevation, forest type) can be analyzed using multiple contingency tables or multiple comparison techniques such as Duncan's Multiple Range Test.

Effects of Silvicultural Treatments

Relationships between owl populations, stand characteristics and silvicultural treatments can be developed from the analysis of habitat characteristics and owl densities and the establishment of habitat preferences. From those relationships, it can be inferred as to what effects silvicultural treatments have an owl populations on the study area.

RESULTS

Owl Species

Of the thirteen endemic owl species which occur in Utah (Behle and Perry 1975), six species and twenty-three individuals were located on the Escalante Ranger District during June-August 1981. These locations were either made by the researcher or by others cooperating with the study. Taped recordings of all 13 endemic owl species were used, with the order of calls corresponding to owl size. Small owls were called before large owls, as recommended by Call (1978). Owl species found include the pygmy owl (Glaucidium gnoma), saw-whet owl (Ageolius acadicus), screech owl (Otus asio), long-eared owl (Asio otus), great-horned owl (Bubo virginianus) and the Mexican spotted owl. Figure 3 shows all owl locations made on the study area. Figures 4-7, timber survey maps for the Escalante Ranger District, show individual owl locations and species.

On Figure 4, several owl locations are shown. A saw-whet owl was heard on 30 July 1981 near the Hog Ranch spring, within the Hog Ranch timber sale, in a small sawtimber, ponderosa pine forest type with a Gambel oak (Quercus gambelii) understory. This area had been thinned in 1979 and 1980 and clearcut in areas, producing an open stand. In addition, a great-horned owl was heard on 14 June 1981 at the Posy Lake picnic area. This area is characterized by a well-stocked stand of pole size aspen with ponderosa pine and Douglas-fir. This owl was seen at an earlier date, during the day at this site, by the campground guard. An unidentified, medium-sized owl was seen on 28 June 1981 south of the Posy Lake campground in a small

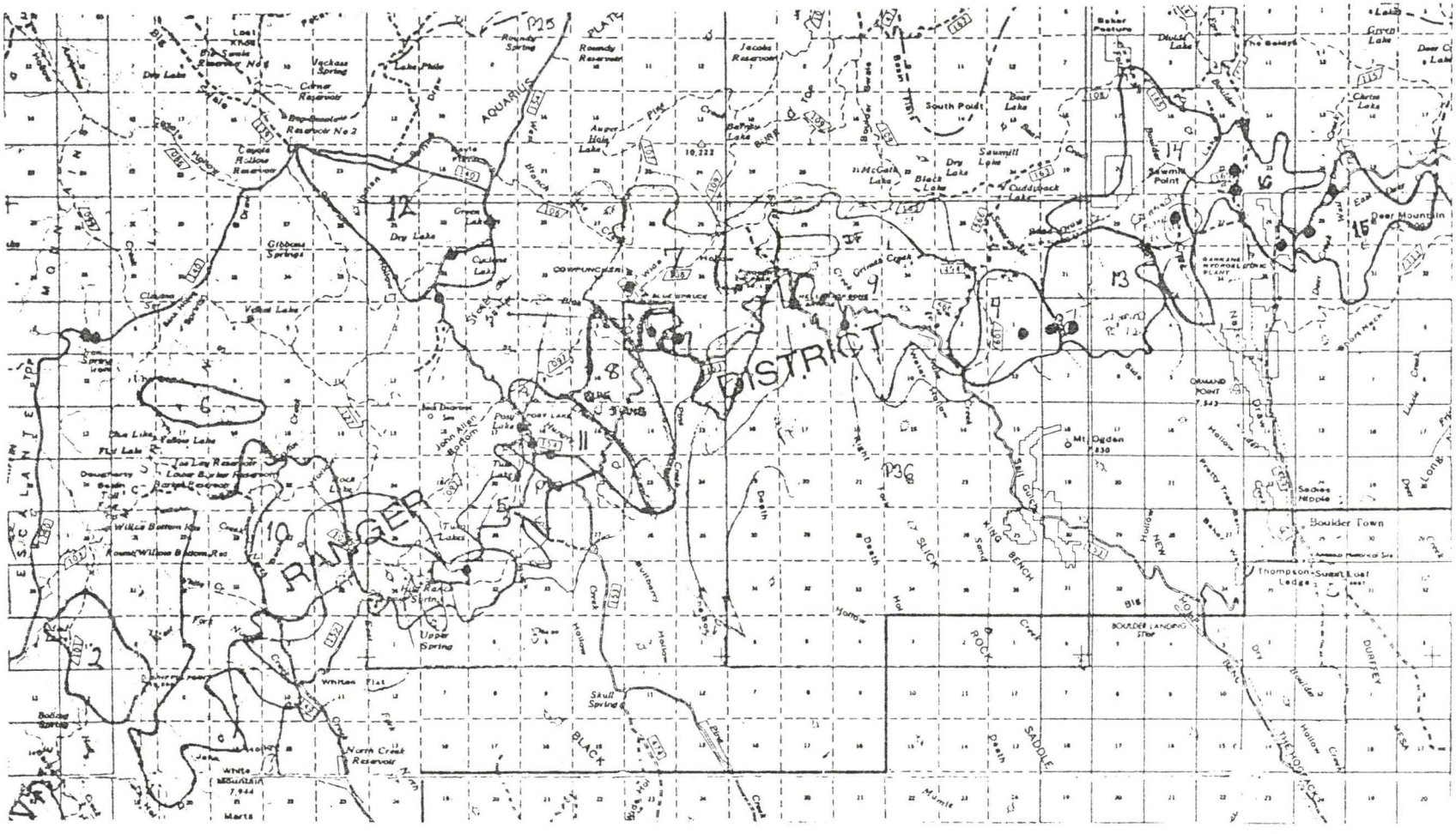


Figure 3. Study plots (timber sales) and owl locations on the Escalante Ranger District, Utah (1981).

Figure 4. Owl locations and 0.5 mile census transects on the Escalante Ranger District, Utah (1981).

sawtimber ponderosa pine forest type. A pygmy owl was heard on 29 June 1981 in the Hungry Creek timber sale, also occurring in a small sawtimber ponderosa pine forest type.

North of Posy Lake, at the southern edge of the Cyclone timber sale, a pygmy owl was heard on 6 July 1981 in a medium-stocked, pole-sized aspen stand with ponderosa pine and Douglas-fir. Within the Cyclone sale, two owls were located. A long-eared owl was heard on 29 July 1981 in a small sawtimber spruce forest type, dominated by Douglas-fir. Another pygmy owl was heard north of Cyclone Lake in the same spruce and Douglas-fir type.

Several owls were seen or heard outside the study plots. They also represent owl use on the Escalante Ranger District. Southwest of the Cyclone timber sale (Figure 5), 9.5 miles west of the Clayton guard station, a pygmy owl and an unidentified owl were seen on 7 July 1981. These owls were found in a small sawtimber, medium-stocked spruce forest type. The unidentified owl was a medium-sized, round-headed, tuftless owl which flew toward the observer in response to the spotted owl call. No vocalizations were made by either of the owls.

Although the Blue Spring timber sale was searched intensively for owls in June-August 1981, no owls were located. The Blue Spring sale is characterized by large sawtimber ponderosa pine which has been thinned, along with a predominantly Gambel oak understory. Since this forest type is favored for sawtimber production on the Escalante district, it is recommended that future owl searches include census transects through the Blue Spring sale. Census transects through this sale can be seen in Figure 4.

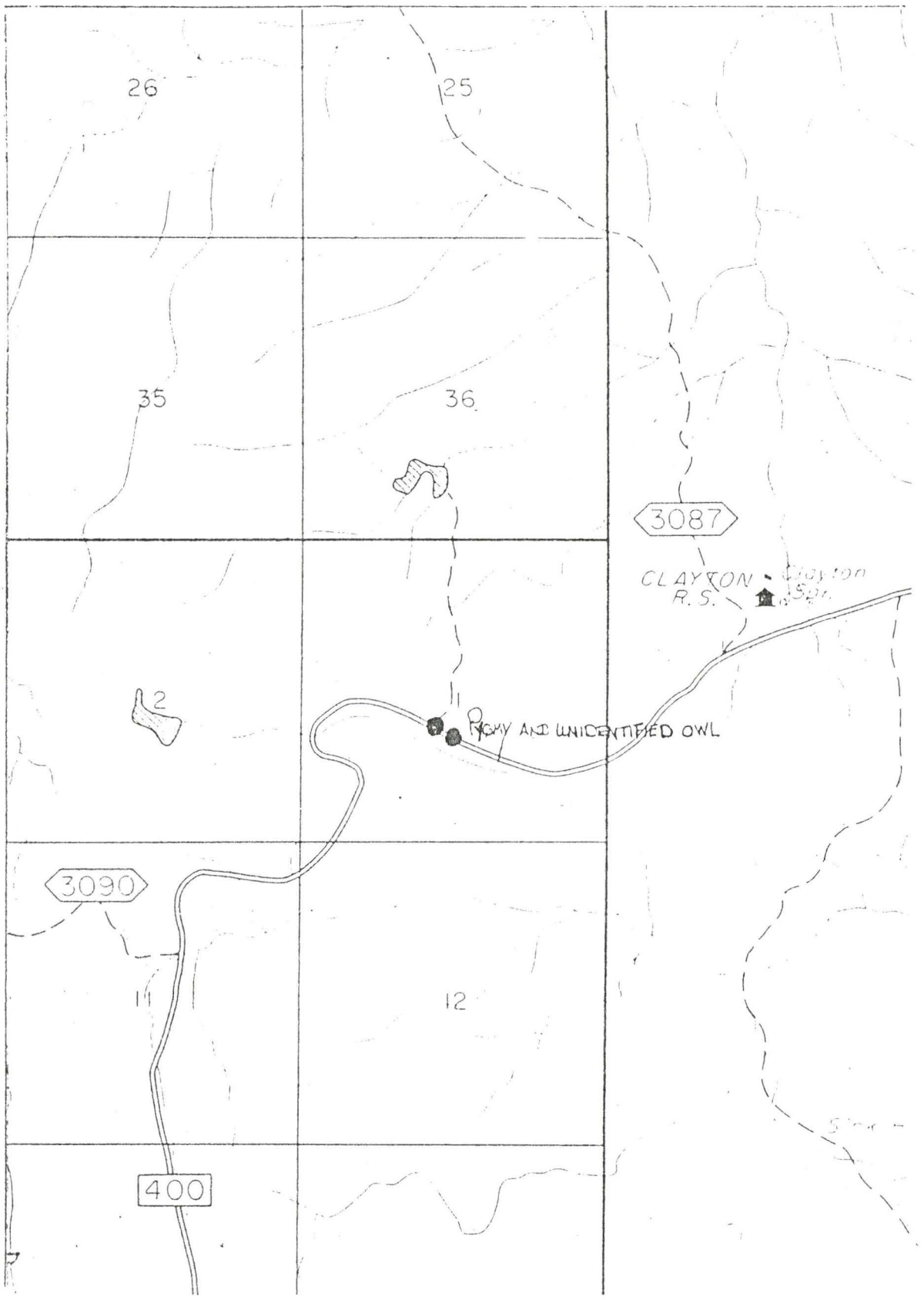


Figure 5. Owl sightings in the Escalante Ranger District, Utah (1981).

Three owls were located on the Cowpuncher timber sale. One unidentified owl fitting the description of a spotted owl was seen by a survey crew on 29 June 1981 southeast of the Blue Spruce campground (Figure 4). This sighting was in the same area a spotted owl had been located in 1981. In addition, a saw-whet owl was seen on 29 June 1981 east of the Blue Spruce campground on Hellsbackbone road (Figure 4). Both owls were located in poorly-stocked, small sawtimber ponderosa pine with Gambel oak. An unidentified owl was seen by Mr. Lyn Briggs, Utah Division of Wildlife Resources Conservation Officer, on 28 June 1981 along Pine Creek, north of the Blue Spruce campground (Figure 4). In 1980, a long-eared owl was seen in this area, but it is not known if the same owl was heard by Mr. Briggs in 1981.

In the Grimes Creek timber sale, a saw-whet owl was heard on 14 July 1981 in poorly-stocked sawtimber ponderosa pine and mature aspen along Sand Creek (Figure 6). In addition, a spotted owl was heard on 2 July 1981 (Figure 6). The response came from the south side of Hellsbackbone road, on the steep, south-facing slopes of the Aquarius Plateau, overlooking The Box-Death Hollow Further Planning Area (Figure 2) and Hellsbackbone bridge (Figure 6). These slopes are characterized by scattered ponderosa pine and pinyon pine (Pinus edulis) among cliff outcrops and greenleaf manzanita (Arctostaphylos patula).

Two great-horned owls were seen on 20 July 1981 along Sweetwater Creek on the east side of the Sweetwater timber sale (Figure 6). On 21 July 1981, one great-horned owl was flushed from a slash pile west of Sweetwater Creek. These owls may have been a nesting pair utilizing the recently thinned, large sawtimber ponderosa pine on the sale. The owls were found perched

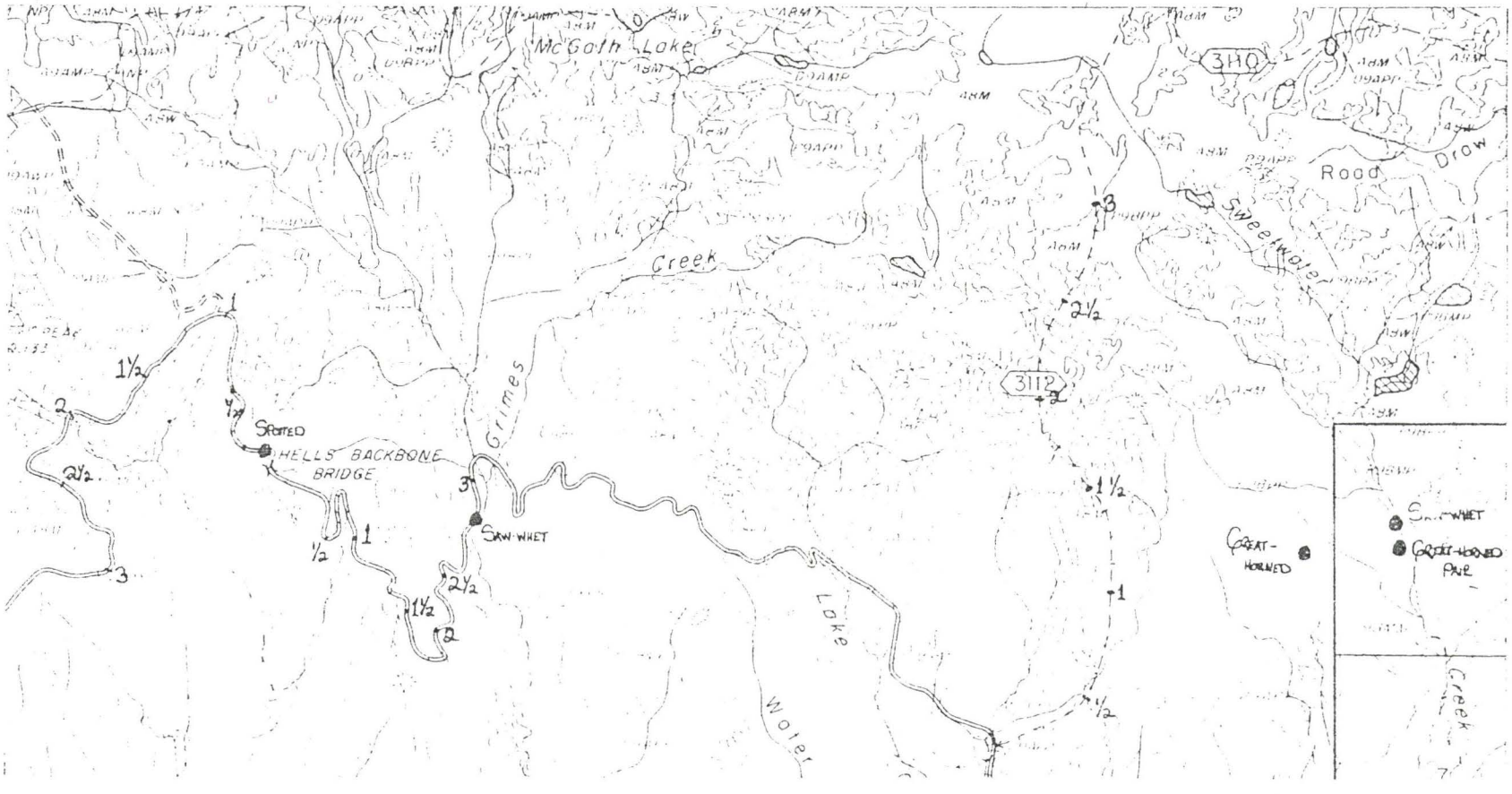


Figure 6. Owl locations and 0.5 mile census transects on the Escalante Ranger District, Utah (1981).

on slash piles in both sightings. In addition, a saw-whet owl was heard along Sweetwater Creek on 21 July 1981 in thinned ponderosa pine with some aspen, spruce and Douglas-fir along the creek (Figure 6).

On Figure 7, owl locations are mapped for the eastern study plots in the study area. A great-horned owl was seen on 15 July 1981 along Boulder Creek in the Garkane timber sale. The area is characterized by thinned, small sawtimber ponderosa pine with scattered slash piles. North of the Garkane hydroelectric plant on the East Fork of Boulder Creek, a saw-whet owl was heard and a pygmy owl was seen on 16 July 1981. The pygmy owl was seen eating a small mammal in a mature ponderosa pine snag. North of the Garkane hydroelectric plant on the Boulder-Torrey road, a screech owl was heard at two sites on 16 July 1981. These two records were close enough to have been made by the same owl. Therefore, it is assumed that one screech owl responded to the calls. All three owls were located in poorly-stocked small sawtimber ponderosa pine. North of the Boulder-Torrey road, in the Deer Mountain timber sale, a pygmy owl was seen on 21 July 1981 in a pole-size, medium-stocked aspen stand including ponderosa pine and Douglas-fir.

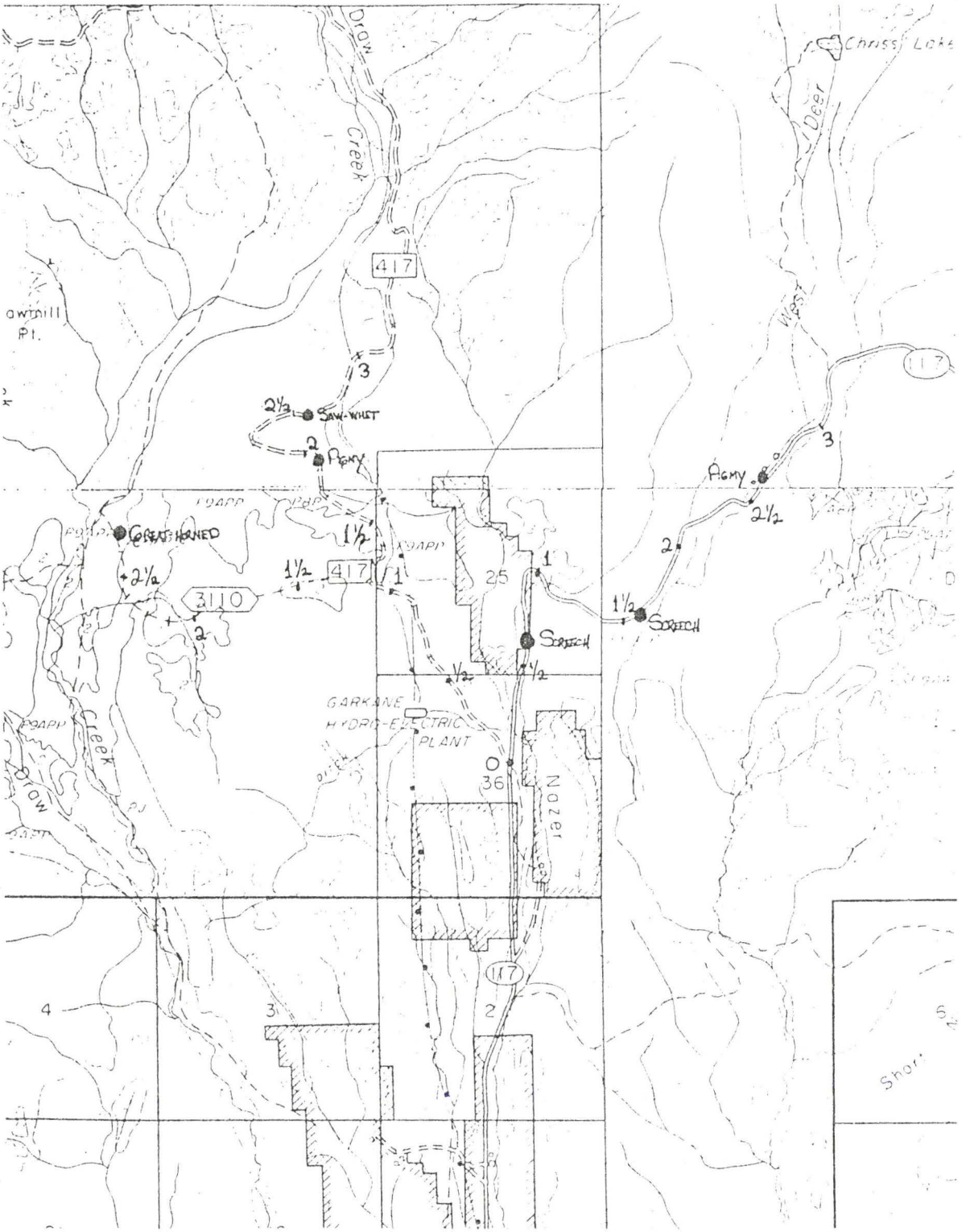


Figure 7. Owl locations and 0.5 mile census transects on the Escalante Ranger District, Utah (1981).

DISCUSSION

The results from owl searches in this study indicate that a variety of owls occupy several ponderosa pine and Douglas-fir forest types within proposed timber sale units of the Escalante Ranger District, Dixie National Forest. Owls can be found in both disturbed and undisturbed sale areas.

Owl Species and Forest Types

From observations made during June-August 1981, some relationships can be drawn between owl occurrence and forest types on the Escalante Ranger District. Many owls were found in stands dominated by ponderosa pine and Gambel oak. Most saw-whet owls were found on thinned, dry sites. However, one saw-whet owl was found in a riparian habitat dominated by aspen and ponderosa pine. A screech owl was also found in the dry ponderosa pine/Gambel oak type. Pearson (1981) found that saw-whet owls selected aspen over any other community type along the Wasatch front in northcentral Utah. In the same study, screech owls were found to select riparian areas, sage and aspen over juniper and conifer. In addition, Winn (1976) found saw-whet owls in mixed coniferous-aspen stands.

Great-horned owls were found in the vicinity of creeks or lakes. They were found in a variety of forest types, including aspen, ponderosa pine and Douglas-fir. Although no consistent relationships can be drawn from this study for saw-whet and screech owls, great-horned owls may prefer areas with access to water and riparian habitats. Pearson (1981) found great-horned owls to be common residents of all plants communities in

northcentral Utah. Pearson (1981) found great-horned owls to show a greater preference for juniper, sage and riparian zones than for aspen and conifer communities on the north slopes of the Wasatch Range.

Areas which received responses from spotted owls were the most unique ponderosa pine forest types. Sparse ponderosa pine and pinyon pine are scattered below Hellsbackbone road, with dense ponderosa pine above the road. Spotted owls may be using the rock ledges and cliffs for nesting, but using the denser ponderosa pine stands for hunting. The Dixie National Forest, in its Environmental Assessment (Johnson 1981), suggests a similar use of the area near Hellsbackbone road and The Box-Death Hollow Further Planning Area. The assessment suggests that spotted owls in the area may prefer dense stands of conifers for roosting, along with undisturbed ledges and cliffs with pot-holes for nesting.

Limited sightings of spotted owls have been reported in other areas of southern Utah. Spotted owls were seen by Hoffman (1978) in areas typified by dense coniferous and/or mixed stands at or above 7000 feet altitude on the Kaiparowits Plateau in the Escalante Resource Area. Hoffman (1978) suggests that spotted owls may prefer narrow, secluded high altitude canyons. The majority of spotted owl sightings have been in Zion and Capital Reef National Parks. In both parks, spotted owls have been located most often in shaded, narrow, steep-walled canyons (Boner 1977). Canyons in Zion National Park frequented by spotted owls are heavily vegetated with white fir (Abies concolor), Douglas-fir, bigtooth maple (Acer grandidentatum) and boxelder (Acer negundo). Kertell (1977) suggests that the abundance of pot-holes on the canyon sides may serve as nest sites. In addition, spotted owls are known to

be permanent residents of narrow, secluded, steep-walled canyons in Capital Reef (Boner 1977). The bottoms of these canyons are not heavily forested, however, with sparse pinyon pine and box elder used for roosting. In July 1981, the researcher of this study found two spotted owls in Shinob Canyon in Capital Reef National Park (T. 29S, R. 6E, Sec. 25). These owls responded quickly to owl tapes and flew to within a few feet of the researcher. They were frequently seen to perch on the only tall, mature ponderosa pine in the canyon. Thus, if mature trees are available, spotted owls may prefer them for roosting sites.

From this survey of spotted owl findings, it appears that spotted owls may be found in narrow, steep-walled canyons or in sparsely-forested areas near rocky cliffs with pot-holes. Boner (1977) stresses the narrow, cool and shaded canyon setting as most preferred by spotted owls. The high elevation, forested areas from which spotted owls were located on the Escalante Ranger District are typical of other areas in southern Utah where they are known to occur. However, The Box-Death Hollow Further Planning Area below Hellsbackbone bridge may have suitably narrow and shaded canyons for spotted owls.

Pygmy owls also were found in ponderosa pine-Gambel oak forest types. One pygmy owl was seen eating a rodent, perched on a tall ponderosa pine snag. They were found most frequently, however, at the higher elevations of the study area. Two locations of pygmy owls were found in dense, old growth aspen, Douglas-fir and spruce types. Pearson (1981) also found pygmy owls at the higher elevations of his study area. He found pgymy owls to select riparian and aspen over sage, juniper and conifer. Pygmy owls, then, may prefer the cooler, forested areas typical of higher

elevations, or the cooler, shaded riparian zones. Hoffman (1978) found riparian areas to be critically important nesting habitats for some raptors in the Escalante Resource Area.

Like the pygmy owls located on the study area, the long-eared owl was found on the higher elevations of the Aquarius Plateau, at the edge of dense, old growth spruce, Douglas-fir and aspen. One long-eared owl was found by Pearson (1981:18) at the highest elevation in his study area, 8500 feet. Thus, long-eared owls may prefer dense, shaded, old growth conifer types characteristic of the higher elevations on the Escalante Ranger District.

Although calling for flammulated owls was not productive in this study, flammulated owls may live in the study area. Pearson (1981) found one flammulated owl in the Wasatch Range in northcentral Utah. He notes that Winter (1979) proposed that flammulated owls are associated with ponderosa pine communities.

Habitat Preferences

Habitat preferences for the owls found in this study can not be determined precisely, based on 1981 field observations alone. To make accurate estimations of habitat preference, census data should be collected and analyzed as suggested in this study. However, some suggestions have been made regarding owl occurrence and forest types. Further investigations are needed to provide additional evidence for owl and forest type relationships. Habitat preferences may vary with different seasons. Since data for this study was collected only during the summer, data from other seasons might be also useful in characterizing preferred habitat.

Silvicultural Treatments

Although the forest type is useful in typifying an area, it is a broad habitat classification. Its use is limited to make predictions about the response of owl populations to silvicultural treatments. Therefore, it is important to include such habitat information as the overstory and understory constituents of a stand and their characteristics in any analysis of this response. An analysis should also address the predicted successional trends which occur in a plant community following treatment (Winn 1976).

Habitat information gathered in this study was limited primarily to forest types associated with owl occurrences. However, some habitat characteristics were observed which relate to silvicultural treatments. For example, the great-horned owls were found most frequently in thinned stands, often utilizing slash piles. Thinned stands may be accessible to owls for hunting. Furthermore, slash piles may provide cover for small mammals which serve as the prey base for great-horned owls.

In addition, a pygmy owl was found to use a snag for hunting and/or roosting. Long-eared and pygmy owls may need denser coniferous stands with mature trees and old growth present.

Although spotted owls may have specific habitat requirements, (fairly dense stands for roosting and cliff areas for nesting), timber harvesting probably poses little threat to the cliff areas from which spotted owls have responded in the study area. These areas are dominated by noncommercial timber and sandstone. However, these areas should be protected from disturbances such as recreation and road-building activities.

Thus, timber management should consider specific habitat needs of owls when considering treatment alternatives. Management should also

address the competitive exclustion of great-horned owls over other owls (Pearson 1981, Call 1978). Great-horned owls are eurytopic, adapting well to a variety of vegetative types. Other owls, however, may be restricted to a few plant communities. If a stand is managed for great-horned owls, then it is unlikely that other owl species will live in the vicinity. Although several studies indicate that spotted owls do not occur with great-horned owls (Zarn 1974, Kertell 1977), Marcot and Gardetto (1978) found that great-horned owls and spotted owls do occur together. Furthermore, spotted owls are known to prey on smaller owl species, including the pygmy owl, screech owl and saw-whet owl (Bent 1938, Zarn 1974). However, Zarn (1974) reports that flammulated owls do not live in areas occupied by spotted owls.

Furthermore, Winn (1976) notes that certain bird communities can be eliminated from the forest mosaic by silvicultural manipulations which modify succession patterns. For example, birds associated with final successional stages will disappear if the primary objective of management is to shorten overstory rotations.

Thus, birds vary in their adaptability to changing environments. Management objectives associated with species diversity, population and distribution must consider the very sensitive species' habitat needs as well as the needs of easily adaptable species.

Bark beetle program. The primary silvicultural objective set by the Dixie National Forest for the Escalante Ranger District is to reduce insect infestation due to the mountain pine beetle by salvaging timber killed by the beetle, removing old growth timber and improving stand productivity (Johnson 1981). The environmental assessment for the

district recommends that conventional methods be used for timber removal, (a tractor-jammer skid method and a piling method of slash disposal), but that allowances be made for multiple use, including wildlife considerations (Johnson 1981). The assessment has several recommendations directed at wildlife management. First, that riparian areas be saved as important wildlife habitat. Second, that snags be at or above the maximum number needed to maintain snag-dependent species. Third, that spotted owl habitat be protected and maintained by leaving one-two acres of timber unharvested within 0.25 mile of The Box-Death Hollow Further Planning Area. The assessment recommends that no sale activities be allowed on The Box-Death Hollow Further Planning Area.

The Escalante Timber Harvest and Bark Beetle Control Program identifies silvicultural practices which were chosen to deal with the bark beetle problem (Dumas 1981). Beetle-suseptible trees, predominantly large, over-mature ponderosa pine, would be harvested. Infested and abandoned trees would be salvaged. In addition, overstocked stands of young trees would be thinned and trees would be planted in unstocked areas.

The results from this study indicate that the silvicultural alternatives proposed by the Escalante Ranger District would probably maintain current levels of owl populations on the district, if certain precautions are taken. For example, some large over-mature trees should be left as nesting sites for cavity-nesting owls and as future snags benefitting many owl species. Some stands should be left uncut and allowed to reach climax stages. This applies particularly to mixed conifer stands at the higher elevations. By allowing stands to reach climax, habitat needs of owls requiring that stage would be met. For mixtures of ponderosa pine and Douglas-fir,

uneven-aged management favors Douglas-fir or other shade-tolerant species (USDA-Forest Service 1981). Shade-tolerant species may benefit owls which prefer cooler, dense stands, such as the long-eared owl.

However, many stands on the Escalante Ranger District are badly infected with the bark beetle. When the choice of a silvicultural system is complicated by disease, choices of cutting methods are often limited to sanitation cuts, clearcutting and group selection (USDA-Forest Service 1981).

Timber production activities of all kinds can have an impact on bird habitats. These activities include timber harvesting (logging) and cultural treatments (Gould 1980). Most of the timber harvested during the next two or three decades will come from regeneration cuts in old growth and mature stands (Gould 1980). Regeneration cuts probably have the greatest potential of any other harvesting system to alter bird habitats. On the Escalante Ranger District, some partial cutting (shelterwood cuts) as well as clearcutting and group selection are planned (Dumas pers. comm.). However, clearcuts and shelterwood cuts would provide even-aged stands. These stands would not provide diverse habitat for owl populations, probably limiting use to great-horned owls and other species which do not require a variety of tree age classes and sizes.

In addition to timber harvesting, cultural treatments, including transportation system development and forest fuel management, can disturb bird habitat (Stubblefield 1980). Transportation systems continue to be developed in the study area. Road-building activity was intensive along Hellsbackbone road during 1981 in preparation for timber harvesting in 1982. This activity may have disturbed owls enough to affect their

response to recorded calls. It is not known whether road-building permanently displaces owls or disturbs their nesting activities in the study area. Fuel management encompasses many methods of forest fuels treatment, including piling and burning of slash, scattering slash, fireline construction and felling of snags (Stubblefield 1980). Piling slash has been suggested by this study to benefit great-horned owls. However, certain practices, such as snag removal, could seriously affect the availability of nesting sites for such cavity-nesting species as the screech owl (Robbins et al. 1966). The Dixie National Forest has recommended that snag densities of two snags per acre be maintained for cavity-nesters on timber sales on the Escalante Ranger District (Johnson 1981). These guidelines should be followed while efforts are made to remove old growth timber prone to the mountain pine beetle on the Escalante Ranger District.

SUMMARY AND RECOMMENDATIONS

A two year study was designed to determine the response of selected owl species to silvicultural treatments on the Dixie National Forest, Utah. The first season of field work was conducted during June-August 1981 on the Escalante Ranger District of the Dixie National Forest. At that time, six species of owls and twenty-three individuals responded to taped owl calls within and in the vicinity of proposed timber sales on the Escalante Ranger District. These species include the pygmy owl, saw-whet owl, screech owl, long-eared owl, great-horned owl and Mexican spotted owl. Several unidentified owls also responded. At the end of 1981, the project was terminated and no further data were collected.

However, data collected in 1981 provides information regarding owl species occurrence and distribution. Owls were found to occupy a variety of ponderosa pine and Douglas-fir forest types on the Escalante Ranger District. Some owls indicated a preference for old growth mixed conifer, others for riparian zones and several owls utilized thinned stands. Spotted owls on the Escalante Ranger District may prefer the rock ledges and cliffs characteristic of The Box-Death Hollow Further Planning Area for nesting and adjacent ponderosa pine stands for roosting.

The effects of silvicultural treatments on owl populations can be inferred from information gathered on owl species occurrence and habitat characteristics. Owls were found in both undisturbed, dense stands characterized by old growth, as well as disturbed stands which had been

cut or thinned. Planned silvicultural treatments on the Escalante Ranger District include shelterwood cuts and group selection in efforts to control a mountain pine beetle epidemic. Although shelterwood cuts may inhibit diversity in owl populations, group selection would probably encourage habitat use by a variety of owls. Piled slash treatments may benefit some owls, but not others.

Further investigations are needed on owl populations and owl habitat preferences on the Dixie National Forest. Using the methods outlined in this study, owl populations can be monitored on the Escalante Ranger District. From censusing, densities of owl populations can be obtained. From evaluating forest types and habitat characteristics, preferred habitat can be calculated.

Censusing efforts should be concentrated during the breeding season for several reasons. The onset of the breeding season can vary with annual precipitation and snowdepth, with nesting beginning earlier during dry years (Hoffman 1978, Pearson pers. comm.). Furthermore, censusing efforts may be less productive following the nesting period when owls no longer respond territorially to their own kind (Boner 1977). These factors may have affected efforts to locate owls in June-August in this study. In addition, nest sites should be identified, with attention paid to snags occupied by cavity-nesters.

Furthermore, attention should be given to riparian zones, since these areas are rich in species diversity and sensitive to habitat alteration (Stubblefield 1980). Also, studies investigating the dietary habits of owls should be initiated to provide information on preferred prey. Pellets, castings and other prey items could be gathered from nesting and

and roosting sites.

Additional information is needed on the locations and habitat needs of the Mexican spotted owls on the Escalante Ranger District. The Box-Death Hollow Further Planning Area and adjacent areas on Hellsbackbone road should be closely monitored. If additional sightings confirm the presence of spotted owls on the Escalante Ranger District, then measures for protecting its habitat should be closely followed, as dictated by the National Forest Management Act (USDA-Forest Service 1979).

In conclusion, it is recommended that the Forest Service monitor owl populations on the Escalante Ranger District as timber harvesting and regeneration activities continue and new trends develop in timber management. Finally, silvicultural practices should be chosen which provide suitable habitat diversity to maintain owl populations.

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APPENDIXES

Appendix 1. OWL CENSUS RECORD

Observer _____ (1) Date _____ Julian (4) Time: Start (5) End (13)

Weather: Sky _____ Precip. _____ Wind _____ Temp. _____°F.

Phase of moon _____ Bright or dark night _____

Study plots _____, _____, _____

Census transect #s _____, _____, _____, _____, _____, _____, _____, _____

Mileage: Start _____ End _____

Methods: Call _____ 1. Vocal 2. Vocal with hailer 3. Tape 4. Tape with hailer

Species played and order _____, _____, _____, _____, _____, _____, _____, _____, _____, _____

Response:

	Species	1. Visual	2. Call	Time	Study plot	Transect #	Comments
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							

Appendix 2. OWL LOCATION RECORD

Study plot _____ (1) Species # _____ (4) (Codes below)

Observer _____ (9) Date _____ Julian (12) Time ____

Type: C Census S Search (25)

Location: Census transect # ____ Mileage ____

Forest type ____ Comments (Location):

Weather: Sky _____ (40) Precip. _____ (43) Wind _____ (46)

Temp. ____ F.

Phase of moon _____ Bright or dark night _____

First or relocation ____ (47) F First R Relocation

Type of observation ____ C Call V Visual B Both

Accuracy ____ C Certain G Good Q Questionable # of owls ____

Activity ____ F Foraging R Roosting M Moving C Calling T Territorial

N On nest O Other _____

Comments (Observation):

Species codes:

GHO	great-horned owl (ie. GHO1 = great-horned owl #1)
SWO	saw-whet owl
SEO	short-eared owl
LEO	long-eared owl
OPO	pigmy owl
OSO	screech owl
MSO	Mexican spotted owl
OFO	flammulated owl

Appendix 3. STUDY PLOT HABITAT RECORD

Study plot ____ (1) Observer ____ (4) Date ____

Julian ____ (7) Time ____ (11)

Location: Quad ____ Drainage ____ T. __ (15) R. __ Sec. __ ¼, ¼Sec. __ (21)

Topog. position: Vertical ___ Relief ___ (27) Elevation ____ (30)

Aspect ____ (36)° Slope ___% Distance to water ____ (44)ft.

Plot description (Presence of roads, silvicultural treatments, stand origin, stand vigor):

Forest type _____

Overstory: Species 1. ____ DBH ___in. Ht. ____ft. Density ____ trees/ pl

2. ____ ___ ____ ____

3. ____ ___ ____ ____

Understory: Species 1. ____ Ht. ____ Density ____ plants/plot

2. ____ ____ ____

3. ____ ____ ____

Snags: Species 1. ____ DBH ___in. Ht. ____ft. Density ____ trees/ pl

2. ____ ___ ____ ____

3. ____ ___ ____ ____

Canopy cover ___% Ground cover ___% (H) Canopy Ht. ___ft. (O)

Stand age ___yrs. Stand structure ___ Homogeneous Other _____

Appendix 3. Continued.

Nest tree: Species ⌊_⌋⌊_⌋ DBH ⌊_⌋⌊_⌋ in. Ht. ⌊_⌋⌊_⌋⌊_⌋⌊_⌋ ft.

Status ⌊_⌋ L Living D Dead

Nest type ⌊_⌋ A Abandoned nest C Cavity

Distance to foraging area ⌊_⌋⌊_⌋ miles

Distance to nearest known owls/owl nests ⌊_⌋⌊_⌋ miles